TENMARS

RF three-Axis Field Strength Meter

TM-195

User's Manual

CE

HB2TM1950005

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Axis RF Meter Quick Start Guide

This meter has many capabilities, including memory, alarm, date/time, average etc. which will require some study of the manual to use properly. However, you can quickly and easily begin making measurements right out of the box. Just follow these simple steps:

1. Insert 9V battery.
2. Turn meter on with GREEN button.
3. Press XYX/MEM button until all three (XYZ) letters are displayed on the screen (to the left of the main number.
4. Press UNIT/ENTER button until the desired units are displayed below the main number (we recommend using mV/m... and we recommend a maximum level of 614 mV/m for prolonged exposure).

You are now ready to make your first measurements!

1 Introduction

This meter is designed for measuring and monitoring Radio–Frequency electromagnetic field strength. The meter is calibrated precisely over the frequency range of 50Mz~3.5 GHZ.

2 Simple a method of operation

Press "⏻" button to power on. To change measuring unit (mV/m), push "UNIT ENTER" button to change the unit. Electric field strength (V/m). Computed magnetic field strength (mA /m). Computed power density (mW/m^2). Computed power density ($\mu W/cm^2$).

Press "MAX/REL"this key to change sensor axis selector :"All axis" → "X axis "→ "Y axis" → "Z axis".

3 Fundamentals

Electromagnetic pollution:
This meter is used to indicate electromagnetic pollution generated artificially. Wherever there is a voltage or a current, electric (E) and magnetic (H) fields arise. All types of radio broadcasting and TV transmitters produce electromagnetic fields, and they also arise in industry, business and the home, where they affect us even if our sense organs perceive nothing.

3.1 Electric field strength (E):

A field vector quantity that represents the force (F) on an infinitesimal unit positive test charge (q) at a point divided by that charge. Electric field strength is expressed in units of volts per meter (mV/m). This meter measures electric field strength directly.

3.2 Magnetic field strength (H):

A field vector that is equal to the magnetic flux density divided by the permeability of the medium. Magnetic field strength is expressed in units of amperes per meter (A/m). In far field situations, one can calculate the magnetic field from the electric field value. This meter can display the calculated magnetic field strength.

3.3 Power density (S):

Power per unit area normal (perpendicular) to the direction of propagation, usually expressed in units of Watts per square meter (W/m^2) or, for convenience, units such as mill Watts per square centimeter (mW/cm^2).

3.4 The characteristic of electromagnetic fields:

Electromagnetic fields propagate as waves and travel at the speed of light (C). The wavelength is proportional to the frequency.

λ (wavelength) = C (speed of light) / f (frequency)

If the distance to the field source is less than three wavelengths, then we are usually in the near field. If the distance is more than three wavelengths, the far-field conditions usually hold.
In near field conditions, the magnetic field value cannot be calculated from the electric field value. This meter is designed for reliable far field measurements only.

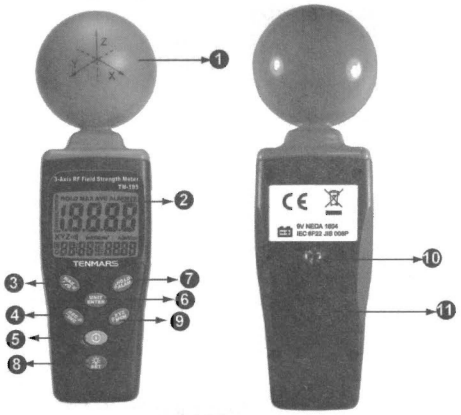
4 Application

- Quite often routine, maintenance and service work has to be done in areas where active electromagnetic fields are present, e.g. in broadcasting stations, etc. Additionally, other employees may be exposed to electromagnetic radiation. In such cases, it is essential that personnel be not exposed to dangerous levels of electromagnetic radiation, such as:
- High frequency (RF) electromagnetic wave field strength measurement.
- Mobile phone base station antenna radiation power density measurement.
- Wireless communication applications (CW, TDMA, GSM, DECT).
- RF power measurement for transmitters.
- Wireless LAN (Wi-Fi) detection, installation.
- Spy camera, wireless bug finder.
- Cellular /Cordless phone radiation safety level. Microwave oven leakage detection.
- Personal living environment EMF safety.

5 Features

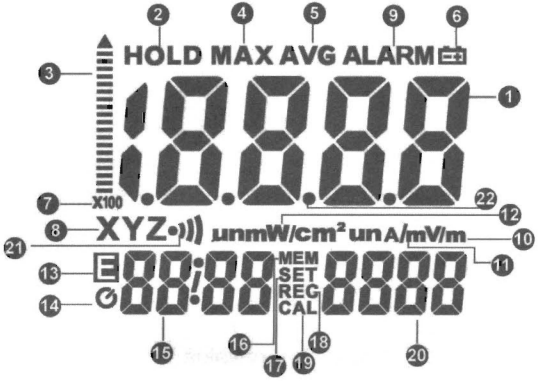
- The meter is a broadband device for monitoring high- frequency radiation in the range from 50MHz to 3.5GHz
- The non-directional electric field antenna and high sensitivity also allow measurements of electric field strength in TEM cells and absorber rooms.
- The auto-ranging units of measurement and the measurement types have been selected to expressed in units of electrical and magnetic field strength and power density.
- At high frequencies, the power density is of particular significance. It provides a measure of the power absorbed by a person exposed to the field. This power level must be kept as low as possible at high frequencies.
- The meter can be set to display the instantaneous value, the maximum value measured or the average value.
- Non-directional (isotropic) measurement with three-axis measurement sensor.
- High dynamic range due to three- channel digital results processing.
- Configurable alarm threshold and memory function.
- Easy & safe to use
- Low battery detector "".
- Over load indication "OL".

6 Identifying Parts



1. RF three-Axle Sensor.
2. Liquid-crystal LCD.
3. MAX / AVG / R Button.
4. Record / Time / L Button.
5. Power Button.
6. UNIT / ENTER switch Button.
7. Hold / ALARM on/off / Up Button.
8. Backlight/Set
9. XYZ / MEM / Down Button.
10. Tripod mounting screw.
11. Battery cover .

7 LCD description



1. Primary Display
2. Hold symbol
3. Analogue bar graph
4. MAX symbol
5. AVG symbol
6. Low battery symbol
7. x1x10x100 unit
8. X.Y.Z unit
9. ALARM unit
10. mV/m,V/m (E)
11. μA/m mA /m unit (H)
12. μW/m, μW/cm^{2}unit
13. E symbol
14. Auto power off symbol
15. Time unit (month:day) (hour: minute) (second)
16. MEM reading symbol
17. SET symbol
18. REC symbol
19. CAL symbol
20. Secondary Display
21. BUZZER symbol
22. Decimal point

8 Specifications

8.1 General specifications

- Display type : Liquid-crystal (LCD), 4-1/2 digits maximum reading 19999.
- Measurement method : Digital, triaxial measurement.
- Directional characteristic : Isotropic (triaxial).
- Measurement range selection: one continuous range.
- Display resolution : 0.1mV/m, 0.1μA/m, 0.001μW/m^2, 0.001μW/cm^2
- Setting time : typically 1.5s (0 to 90% measurement value.)
- Sample rate : 3 times per second.
- Audible alarm: Buzzer.
- Units: mV/m, V/m, μA/m, mA/m, μW/m^2, mW/m^2, μW/cm^2
- Display value : Instantaneous measured value, maximum value, average value, or maximum average value.
- Alarm function : adjustable threshold with ON / OFF.
- Calibration factor CAL : adjustable.
- Manual data memory and read storage : 200 data sets.
- Batteries : 9V NEDA 1604, IEC 6F 22 or JIS 006P.

- Battery life : Approximate 15 hours.
- Auto power off : Default time 15 minutes. Adjustable threshold 0~99 minutes.
- Operating temperature range : 0°C to + 50°C.
- Operating humidity range : 25% to 75% RH.
- Storage temperatures range : -10°C to +60°C.
- Storage humidity range : 0% to 80% RH.
- Dimensions : 60(L) X60(W) X195(H) mm.
- Weight (including battery) : Approx. 200g.
- Accessories : User's manual, 9V battery, Carrying case.

EMC

This tester was designed in accordance with EMC Standards in force and its compatibility has been tested in accordance with EN61326-1 (2006).

8.2 Electrical specifications

- Unless otherwise stated, the following specifications hold under the following conditions:
- The meter is located in the far field of a source; the sensor head is pointed towards the source.
- Ambient temperature : +23°C ±3°C.
- Relative air humidity 25%~75%3
- Sensor type : electrical field (E).
- Frequency range : 50MHz ~ 3.5GHz.

- Specified measurement range:
  - CW signal (f >50MHz) : 38mV/m to 20.00 V/m, 53.0uA/m to 53.74mA/m , 0.1uW/m^2 to1.089W/m^2, 0.001uW/cm^2~108.9uW/cm^2
  - Dynamic range : Typically 75dB.
  - Absolute error at 1V/m and 2.45GHz : ±1.0 dB.

- Frequency response :
  - Sensor taking into account the typical CAL factor : ±2.4dB (50 MHz to 1.9 GHz). ±1.0 dB (1.9 GHz to 3.5GHz).
  - Isotropy deviation : Typically ±1.0 dB (f 2.45GHz).
  - Overload limit : 0.42 mW/cm^2 (11 V/m) per axis.
  - Overload limit : (0 to 50°C): ±0.2dB.

8.3 Units of measurement

The meter measures the electrical component of the field; the default units are those of electrical field strength (mV/m or V/m). The meter converts the measurement values to the other units of measurement, i.e. the corresponding magnetic

field strength units (µA/m or mA/m) and power density units (µW/m^2 , mW/m^2 or µW/cm^2) using the standard far-field formulae for electromagnetic radiation.

8.4 Result modes

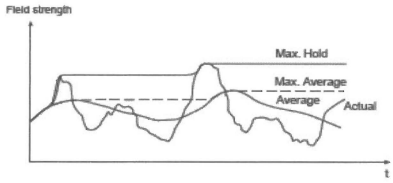
The bar graph display always shows the instantaneous measured dynamic range value. The digital display shows the result according to one of three modes, which can be selected.

Instantaneous : The display shows the last value measured by the sensor, no symbol is displayed. Instantaneous mode is the default setting when the meter is turned on.

Maximum instantaneous (MAX) : The digital display shows the highest instantaneous value measured so far, the "MAX "symbol is displayed.

Average (AVG) : The digital display shows the average value measured, the "AVG" symbol is displayed.

The following graph shows of Instantaneous (actual), MAX (hold), AVG and MAX/AVG:



9 Measurement Procedures and Preparation

Battery loading : Remove the battery cover on the back and put a 9V battery inside.
Battery replacement: When the low battery symbol of "⊟+" appears on the LCD display, the battery should be replaced with a new one.

9.1 POWER button :

Press"⏻"button to power on.

Press"⏻"button to power off.

9.2 Data hold button:

Press the "HOLD/ALARM" button to go into hold mode, and "HOLD" appears on the screen to allow you to read the data.

Press the "HOLD/ALARM" button once again to deactivate it.

9.3 Units button :

Change units with the "UNITS" key as follows.
Electric field strength (V/m)
Computed magnetic field strength (mA/m).
Computed power density (mW/m^2).
Computed power density ($\mu W/cm^2$).

Press "UNIT/ENTER" button to change the unit. Possible units : mV/m, V/m, μA/m , mA/m, $\mu W/m^2$, mW/m^2, $\mu W/cm^2$

9.4 MAX / AVG Record:

Press "MAX/AVG" key to switch to the next display. The display switches from MAX to AVG to MAX/AVG

and back to MAX.

Press and hold "MAX/AVG" key for 3 seconds to disable this function.

The maximum averaging storage is up to 99 minutes and 99 seconds. After this period of time, updating will stop automatically and the LCD displays E.

9.5 Manual data memory storing

Push "REC/TIME" button, the meter will save the current measured result, and REC with a number 001~200 will appear.
Manual data memory storing: 200 data sets.
Over load indication : "OL".

9.6 Backlight Display and Reading in The Dark.

Press "SET" key backlight light on. Again Press "SET" button to power off.
Backlight light turns off automatically after 30 seconds.

9.7 XYZ:

Press "XYZ/MEM" this key to change sensor axis selector : "All axis" → "X axis "→ "Y axis" → "Z axis".

9.8 Alarm ON/OFF Setup

Press and hold "⏻" then press "HOLD/ALARM" key to switch the alarm function on. The "ALARM" symbols in the display indicates that the alarm function is on. Press and hold "⏻" and "HOLD/ALARM" key to turn off the alarm function. When the Alarm

sounds, the display shows .

9.9 Viewing Data Records

Press hold "⏻" button and press "XYZ MEM" button to view the saved data records

Use "XYZ MEM" or "XYZ MEM" button to see the next or previous records

Press "UNIT ENTER" key to close the setup, exit the mode.

9.10 Clock LCD Display

Press hold "⏻" and "REC TIME" button to select the display method of the Year, Month, Date, Hour and Second.

This meter's clock uses 24 hour time setting.

Default time mode setting is "2010/01/07 00 : 02" ":00".

10 Setup Mode

While the meter is on, press hold "⏻" button and "SET" button to enter the setup mode.

Press "SET" button to scroll through the setup function.

Push "UNIT ENTER" button to save setup data.

Note 1 : you can set up 6 different functions in setup mode

Default Clock Setup

setup 1 : Setting the alarm limit value (ALARM).

setup 2 : Clear data logger memory.

setup 3 : Analogue bar graph x1 x10 x100.

setup 4 : Auto Power Off Time.

setup 5 : Setting the calibration factor (CAL).

10.1 Clock Setup-1

Press hold "⏻" button and press "SET" button first to enable Clock Setup.

This meter clock is 24 hour time setting.

Use "HOLD/ALARM" or "XYZ/MEM" to change digit(Hour→day→Month→year→Minute).

Use "REC/TIME" or "MAX/AVG" to select the digit you want to adjust.

Press "UNIT/ENTER" button to save the setting.

Date/Time default format : 2009/12/21 12:12.

Year format : 2000~2099 display as 00 ~ 99.

10.2 Setting the alarm limit value (ALARM)-2

The alarm limit value determines the level at which the alarm wil sound. The alarm limit value can be edited only in the V/m unit. The ALARM setting range is from 0.001 to 999.9 V/m.

ALARM default is set at 999.9 V/m.

Alarm limit function is only used for total three axial value.

While the meter in ON, press and hold "⏻" button and press "SET" button to enter Setup Mode.

Press "SET" button 1 more time to enter the alarm setting mode, the readout value is flashing and "V/m" unit is displayed.

Press "MAX/AVG" key to move decimal.

Press "REC/TIME" key to select the desired digit.

Press "HOLD/ALARM" and "XYZ/MEM" button to change digit.

Press "UNIT/ENTER" key to store the new setting value and exit.

10.3 DEL data logger memorysetup-3

While the meter in ON, press and hold on "⏻" button and press "SET" button to enter Setup Mode.

Press "SET" button 2 more times to enter clear data logger memory mode (3.SET). 88 will show on the display.

To exit without clearing memory, press "UNIT ENTER" key
To clear the memory, press "HOLD ALARM" then press "UNIT ENTER"

10.4 Analog bar graph setup-4

While the meter in ON, press hold "⏻" button and press "SET" , button to enter Setup Mode.
Press "SET" button 3 more times to : enter analogue bar graph setting mode. The "graph" unit is flashing. Current setting of x1, x10, or x100 is displayed at bottom of graph. X1 is normal setting. X10 is 10 times more sensitive, x100 is 100 times more sensitive.
Press "HOLD ALARM" or "XYZ MEM" to select the desired value:

Press "UNIT ENTER" key to store the new setting value and exit.

10.5 Auto Power Off Time function setup-5

While the meter is on, press and hold "⏻" button and press "SET" , button to enter the auto power off Setup Mode.
Press "SET" button 4 more times.
Press "HOLD ALARM" and "XYZ MEM" button to change the value. Auto power off time default setting is 15 minutes. Maximum auto power off time : 99 minutes. Set value to 00 to disable auto power off.
Press "UNIT ENTER" key to store the new setting value and exit. The symbol ⏲ is displayed.

10.6 Setting the calibration factor (CAL)-6

Press hold "⏻" button and press "SET" button to enter Setup Mode.

Press "SET" button 5 more times to enter the calibration factor setup mode, The CAL setting range is from 0.10 to 9.99. Default is 1.00 which is appropriate for most situations.

Use "REC TIME" or "MAX MIN" to select the desired digit.

Press "HOLD ALARM" and "XYZ MEM" button to change the digit

Press "UNIT ENTER" key to store the new setting value and exit.

CAL CAL CAL

Calibration factor (CAL)

The calibration factor CAL serves to calibrate the display for a specific frequency when the frequency of a single signal is known. The field strength value measured internally is multiplied by the value of CAL that has been entered and the resulting value is displayed. The CAL factor is often used as a means of entering the sensitivity of the field sensor in terms of its frequency response in order to improve measurement accuracy.

11 Making measurements

Important :

The following effect will be noted with all field strength meters:

If the sensor is moved quickly, excessive field strength values could be displayed. This effect is caused by electrostatic charges.

Recommendation :

Hold the meter steady during the measurement.

12 Short-term measurements

Application :

Use either the "instantaneous" or the "Max. instantaneous" mode, if the characteristics and orientation of the field are unknown when entering an area exposed to electromagnetic radiation.

Procedure :

Hold the meter at arm's length.

Make several measurements at various locations around your work place or the interested areas as described above. This is particularly important if the field conditions are unknown and possibly dangerous.

Pay special attention to measuring the vicinity of possible radiation sources. Apart from active

sources, those components connected to a source may also act as radiators. For example , the cables used in diathermy equipment may also radiate electromagnetic energy. Note that metallic objects within the field may locally concentrate or amplify the field from a distant source.

13 Long-term exposure measurements

Location

Place the meter between yourself and the suspected source of radiation. Make measurements at those points where parts of your body are nearest to the source of radiation.

Note : Use the "Average" or" Max average" modes only when the instantaneous measurement values are fluctuating greatly.

You may fix the meter to a wooden or plastic tripod.

14 Safety Information

CAUTION

Before making a measurement, check if the low battery symbol" [-+] " is shown on the display as soon as the meter is switched on. Change the battery if the symbol is displayed

In the case of prolonged storage, it is preferable to remove the battery from the meter.

Avoid shaking the meter, particularly in the measurement mode.

The atmospheric condition outside specified limits and improper handling may adversely affect the accuracy and function of the meter.

15 Safety Information

DANGER

In some cases, work in the vicinity of powerful radiation sources can be a risk to your life.
Be aware that persons with electronic implants (e.g. cardiac pacemakers) are subject to particular dangers in some cases.
Observe the local safety regulations of the facility operation.
Observe the operating instructions for equipment, which is used to generate, conduct, or consume electromagnetic energy.
Be aware that secondary radiators (e.g. reflective objects such as a metallic fence) can cause a local amplification of the field.
Be aware that the field strength in proximity to radiators increases proportionally to the inverse cube of the distance. This means that enormous field strengths can result in the immediate vicinity of small radiation sources (e.g. leak in wave guides, inductive ovens)
Field strength measuring devices can underrate pulsed signals. Particularly with radar signals, significant measurement errors can arise.
All field strength measuring devices have a limited specified frequency range. Fields with spectral components outside of this frequency range are generally incorrectly evaluated and tend to be underrated. Before using field strength measuring devices, you should thus be certain that all field components to be measured lie in the specified frequency range of the measuring device.

16 Battery replacement

WARNING

If the symbol "[−+]" appears on the LCD, please replace the battery immediately

- Turn off the instrument.
- Remove the battery cover
- Replace the battery.
- Install the battery cover.

Be sure to turn unit off after use to conserve battery life.

17 Safety Precaution

- For cleaning the instrument use a soft dry cloth. Never use a wet cloth, solvents or water, etc..
- Operation Altitude : Up to 2000M.
- Operating Environment : Indoors use. This instrument has been designed for being used in an environment of pollution degree 2.

18 End of life

Caution : this symbol indicates that equipment and its accessories shall be subject to a separate collection and correct disposal

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